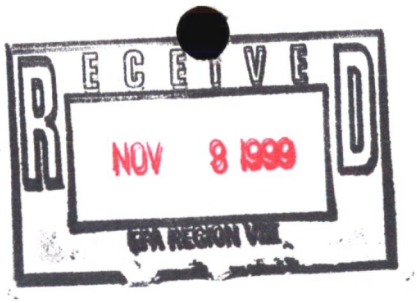
Harding Lawson Associates



HLA

November 9, 1999

42708

Ms. Valois Shea
U.S. EPA Region VIII
Underground Injection Control 8P2-W-GW
999 18th Street
Suite 500
Denver, Colorado 80202-2466

Information for Evaluation of Underground Injection Control
CDOT Region 6 Headquarters
2000 South Holly Street
Denver, Colorado

Dear Ms. Shea:

On behalf of the Colorado Department of Transportation (CDOT), Harding Lawson Associates (HLA) is providing information to the U.S. EPA Underground Injection Control (UIC) program for a remediation system at the CDOT Region 6 Headquarters site. The remedial project consists of a three-month duration, in-situ, biodegradation, pilot-scale test. The test will consist of the injection of nutrients, oxygen releasing compounds, and a co-metabolic food source to stimulate bioactivity to degrade methylene chloride, 1,1 dichloroethene (1,1-DCE), trichloroethene (TCE), and tetrachloroethene (PCE). The project information is being submitted to provide a basis for the U.S. EPA UIC to evaluate the project's impact on the local groundwater system, potential for underground sources of drinking water (USDW) contamination, and whether a permit for its operation should be required or whether the system can be rule authorized.

The information provided in Attachment A consists of the CLASS V – REMEDIATION INFORMATION requested in your facsimile and telephone conversation of November 5, 1999. Class V remediation wells/systems are authorized to inject by rule or permit. As indicated in the facsimile, these remediation wells/systems that have the potential for groundwater contamination or degradation are usually permitted, and those that do not contirbute to contamination or degradation of groundwater are usually rule authorized.

The system is currently under construction and the current schedule would place startup in January, 2000. Please evaluate the attached information and inform us on the correct authorization procedure (rule or permit). Should you have any questions regarding the information presented or require additional information, please contact me at (303) 293-6156.

Sincerely,

HARDING LAWSON ASSOCIATES

Paul H. Weaverling
Senior Geologist
Project Manager

PHW/jkw
EPA_UICInfo.doc/JKW

Attachments: Attachment A – Underground Injection Control Infromation
Attachment B – Analytical Data Tables
Attachment C – Site Maps
Attachment D - State Database Well Information (1 mile radius)
Attachment E – Draft Biodegradation Pilot-scale Injection Testing Work Plan

cc: Theresa Santangelo-Dreiling – CDOT
CDOT Project file

ATTACHMENT A

UNDERGROUND INJECTION CONTROL INFORMATION

ATTACHMENT A

UNDERGROUND INJECTION CONTROL
REQUESTED INFORMATION
CDOT Region 6 Headquarters
2000 South Holly Street
Denver, Colorado 80222

1. **Property owner and operator of facility.**

Owner/Operator: State of Colorado Department of Transportation

Contact: Ms. Theresa Santangelo-Dreiling
CDOT Project Manager
State of Colorado Department of Transportation
Office of Environmental Services
4201 East Arkansas Ave., Room 284
Denver, Colorado 80222

2. **Briefly outline the type of spill and when it occurred.**

The source area is believed to be a former dry well located next to the Materials Laboratory at the Region 6 Headquarters Facility. According to recent interviews, methylene chloride/asphalt cement solution was disposed of in a dry well (potentially from 1966 to the mid 1970s), approximately 12 inches in diameter and 11 feet deep. The well consisted of a corrugated pipe-type construction and was filled with coarse gravel. (Source: URS Greiner, Inc., June 1998, Final Site Investigation Report)

The well was removed and abandoned by Harding Lawson Associates/Layne-Western on December 21-22, 1998.

3. **Analysis of the water from the receiving formation (upgradient from the contamination) and from the contaminated formation (near the source).**

Analytical data is provided on the attached tables and a description of the well locations is provided below:

Up gradient Wells:

C-MW19S – Well completed in the upper zone located up gradient of the Dry Well area. Volatile Organic Compounds were analyzed.

C-MW19D – Well completed in the lower zone well located up gradient of the Dry Well area. Volatile Organic Compounds (VOCs) were analyzed.

Source area Wells:

C-MW20D – Well completed in the lower zone within the plume area. VOCs data are available.

C-MW20S – Well completed in the upper zone within the plume area. VOCs data are available.

C-MW11 – Well completed in the Upper/Lower zone within the plume area. Historical VOCs data are available. (This well has been abandoned.)

Additional Data:

C-MW17D – Well completed below the lower zone located cross gradient southeast of the Dry Well area. Metals, alkalinity, hardness, nitrate as nitrogen, nitrite as nitrogen, sulfate, and total dissolved solids data are available.

C-MW16S - Well completed in the lower zone located within the plume area. Metals, alkalinity, hardness, nitrate as nitrogen, nitrite as nitrogen, sulfate, and total dissolved solids data are available.

4. Hydrologic description, location, depth, and current use of the receiving formation.

Hydrologic description:

Stratigraphy: The geologic strata characterizing the Dry Well area include surficial materials and bedrock strata of the Denver Formation. The surface material consists of unconsolidated deposits of Pleistocene loess (Shroba, 1980) ranging in thickness from 13 to 18 feet. Based on boring logs, the loess overburden consists predominantly of light to dark brown, non-stratified, sandy clay with localized deposits of silty clay and very fine to fine-grained, clayey sand.

The uppermost bedrock formation beneath the study area is the Late Cretaceous to Early Tertiary Denver Formation. Based on boring logs, the Denver Formation consists predominantly of claystone and siltstone with interbedded and interfingering thin, lenticular sandstones and local, thick channel sandstones. Two channel sandstone units have been identified. These units have been designated the A and B sandstones. Figures 3.1, 3.2, and 3.4 summarize the thicknesses of the bedrock sandstones. The A sandstone stratigraphic unit is the shallowest sandstone encountered beneath the dry well area which actually consists of two thin sandstones that are locally continuous. The sandstones are very fine to fine-grained and are generally silty to clayey, indicating deposition in a low-relief environment.

The lower sandstone stratigraphic unit is a relatively thick sandstone that appears to be more laterally continuous beneath the study area than the A sandstone. The upper portion of the sandstone consists of very fine to fine-grained, uncemented sand with interbedded siltstone or thin claystone stringers. The lower portion is coarse-grained at the base to fine-grained near the top, is micaceous and alternates from uncemented to cemented with uncemented zones friable and wet. Cross-bedding has been noted near the base of the unit.

Water-level Data: A water-table elevation map was contoured for the March/April 1999 monitoring event for the study area (Figure 4.1). In the area of the Dry Well the water-level is approximately 18 feet bgs which is below the Denver Formation/overburden contact. The water-table map indicates a horizontal gradient to the northeast across the study area at approximately 0.047 foot/foot. Vertical hydraulic gradients up gradient of the former Dry Well and at the former Dry Well are downward ranging from 0.06 to 0.08 foot/foot. Downgradient of the dry well area vertical gradients are upward ranging from -0.02 to -0.13 foot/foot.

Aquifer Testing: Two aquifer tests were performed in the dry well area to assess the hydraulic properties of the A sandstone (upper zone) and the B sandstone (lower zone). Well C-MW23 was used as the pumping well for the A sandstone test and well C-MW16S was used as the pumping well for the B sandstone test. The A sandstone test was performed for a 58 hour duration at a constant rate of 0.016 gallons per minute (gpm). The B sandstone test was performed for a 68 hour duration at a constant flow rate of 0.039 gpm. Analysis of the A sandstone test indicated a hydraulic conductivity of 3.15×10^{-5} centimeters per second (cm/sec). Analysis of the B sandstone test indicated a hydraulic conductivity of 8.7×10^{-5} cm/sec.

Groundwater Flow Velocity: The horizontal groundwater flow velocity was estimated at 9 to 18 feet per year in the A sandstone (upper zone) using a hydraulic conductivity of 3.15×10^{-5} cm/sec, a lateral hydraulic gradient of 0.047 ft/ft, and an effective porosity of 8.5 percent.

The horizontal groundwater flow velocity in the B sandstone (lower zone) was estimated at 39 feet per year using a hydraulic conductivity of 8×10^{-5} cm/sec, a lateral hydraulic gradient of 0.047 ft/ft, and an effective porosity of 11 percent.

Location:

The site is located northeast of the intersection of East Evans and South Holly Street (2000 South Holly Street). The site is further described as being in the northwest quarter of the northwest quarter of Section 29, Township 4 South, Range 67 West. The location is shown in Figure 1 and a base map of the nearby monitoring wells is presented in Figure 2.1. Groundwater will be injected in a well completed in the upper zone near the dry well and a well completed in the lower zone near abandoned well C-MW11.

Depth:

Upper Zone: Approximately 15 to 30 feet below ground surface
Separation Zone: 2 to 5 feet thick claystone
Lower Zone: Approximately 35 to 55 feet below ground surface

Current Use:

The saturated intervals of the upper and lower zones are not currently used for any purpose near the Site because the permeability of the Denver Formation is low and well yields are very low.

5. Hydrologic study of the area including location of the monitoring wells inside and outside the plume.

The hydrologic study summary is presented in the response to Question Number 5. Plume maps for the upper zone and lower zone including well locations are presented in Figures 5.1 and 5.2.

6. If injection is into an alluvial aquifer, provide locations of surface water bodies, i.e rivers, streams, and lakes, within one mile of injection site (may submit a topographic map).

Injection will be into the Denver Formation bedrock portion of the unconfined aquifer. Cherry Creek is located approximately one mile north east of the site.

7. **Location and depth of all private and public-supply drinking water wells within a 1 mile radius of the injection site that tap the same aquifer as the injection well.**

There are no private and public-supply drinking wells within or near the plume area that are completed in the same aquifer interval. The nearest domestic well is 1/8 to ¼ mile west of the site; however, it is significantly deeper (150 feet). A majority of the wells completed within the receiving formation are monitoring wells at nearby gas stations or the adjacent (downgradient) Redfield Riflescopes Site where a downgradient boundary containment system is being installed. A listing of the wells present within a 1-mile radius are attached. The list was compiled as part of the Modified Environmental Site Assessment Report (September 5, 1997) prepared by URS Greiner, Inc.

8. **Description and operation of the remediation system.**

The injection system components as presented in the Draft Biodegradation Pilot-scale Injection Testing Work Plan (HLA, 1999) consist of the following items:

- Upper zone injection well
- Lower zone injection well
- Treatment building
- Potable water supply
- Liquid phase granular activated carbon vessel
- Stainless steel bag filter with a 2 to 5 micron fabric filter
- Tanks for storing and mixing
- Pumps for metering fluids
- Chemical feedstock including nutrients, hydrogen peroxide, and methane

The pilot-scale testing is scheduled to be performed for a 3 month period and results of testing will be used to assess whether additional work will be performed.

9. **Affect of injection fluid on the quality of the aquifer.**

The concentrations of methylene chloride and the chlorinated solvents are expected to decrease causing the aquifer quality to improve.

The water used to mix with the injected chemicals will be potable water from a source at the site. The water will be treated through liquid phase granular activated carbon to remove any chloride and a 5 micron bag filter to remove any fine material prior to being mixed with the chemicals.

Chemical feedstock – To stimulate the growth of microbial bacteria conducive to degrading methylene chloride and co-metabolizing other chlorinated solvents such as 1,1-DCE, TCE, and PCE, the mixing system will prepare nutrients, an oxygen releasing compound (e.g., hydrogen peroxide), and methane.

– Nutrients - Ammonium nitrate and potassium phosphate will be prepared as a nutrient mixture to be injected at concentrations of approximately 50 mg/L and 5 mg/L, respectively. Groundwater samples from two wells (C-MW16S and C-MW17D) have been analyzed for nitrate as nitrogen resulting in concentrations of 16.1 and 15.7 mg/L. Therefore, the expected

both in the B sandstone
C-MW16S is inside the methylene chloride plume in the B SS
C-MW17D is outside the methylene chloride plume in the B SS

concentration of nitrate as nitrogen will increase to approximately 66 mg/L if biological activity does not use the nitrate as a nutrient source.

– Hydrogen Peroxide - For the pilot-scale test, the proposed concentrations of hydrogen peroxide in the injection stream will range from 100 mg/L to as high as 800 mg/L.

– Methane – Methane gas will be added to the injection stream near the end of the startup period. A rate of approximately 0.39 cubic inches of methane per gallon of injected water will be regulated with a pressure regulator and valves, so that the approximate ratio of methane is delivered to the process water stream. A static mixer will be located in the treatment system immediately downstream of the injection port to thoroughly mix the solution.

10. **Responsible party for the operation, maintenance, and closure of the injection system. A specific closure plan for the removal, closure, or plugging of the remediation system, including an estimate of the closing costs.**

The two injection wells have been permitted by CDOT and will be closed by CDOT.

Contact: Ms. Theresa Santangelo-Dreiling
CDOT Project Manager
State of Colorado Department of Transportation
Office of Environmental Services
4201 East Arkansas Ave., Room 284
Denver, Colorado 80222

An estimate of the plugging cost for the two wells is $15,000.